# 7.0 TIER IV EVALUATION

Tier IV involves case-specific, state-of-the-art testing for toxicity and/or bioaccumulation and is to be used on a case-by-case basis only when lower tiered testing is judged to be insufficient to make complete factual determinations. Insufficient information for a determination may include: inability to reach a clear conclusion based on existing data; statistical differences are inconclusive; evidence is conflicting. Experience to date suggests that Tier IV should only be used in a very few cases. When methods are suitable for wide-spread national use, sediment chronic/sublethal testing will be part of Tier III. Until such time as sediment chronic/sublethal tests are approved for national use in Tier III, they should only be used in Tier IV. However, regional testing manuals may apply appropriate sediment chronic/sublethal tests in Tier III in advance of their inclusion in this national manual provided this is done with a benchmark species (Section 11.2.1) or *in addition to* the testing presently required in Tier III.

Tier IV tests may be conducted for water column evaluations (Figure 3-2) or benthic evaluations (Figure 3-3). In both cases, tests should be carefully selected to address the specific issues relevant to the case in question. Tier IV can further consider human and ecological health concerns, including risk assessment. Case-specific evaluative criteria for Tier IV tests must be:

- agreed upon by EPA and USACE and, where appropriate, the State
- adequate to make factual determinations.

## 7.1 Toxicity Tests

Tier IV toxicity tests (Figure 3-2) should measure end-points of clear ecological importance, for example survival, growth and reproduction. Differences from Tier III tests may include:

- longer duration of exposure
- different species
- different end-points
- exposure in the disposal site environs.

Toxicity determinations in this tier can involve laboratory or field testing or field assessments of resident benthic communities. Field assessments can be difficult to interpret but can yield valuable information on responses of resident organisms to in-place contaminants at the dredging site as compared to a disposal site or site environs as appropriate.

Toxicity identification evaluation procedures (e.g., Ankley et al., 1992a) can also be used in this tier. Such procedures can be applied to sediments when ammonia or hydrogen sulfide could be responsible for toxicity.

## 7.2 Benthic Bioaccumulation

Tier IV bioaccumulation tests (Figure 3-3) differ from Tier III tests in that steady-state tissue concentrations of contaminants of concern are always determined. Such determinations can be made by: longer laboratory exposures than used in Tier III, collecting tissue samples from the field (Section 12.2.2), or *in situ* exposures using transplanted organisms.

Tissue concentrations determined in Tier IV are subject to the same comparisons as in Tier III, specifically to FDA action limits, and to comparisons with organisms exposed to reference sediment. Conclusions possible from such comparisons and evaluative factors which should be assessed are detailed in Section 6.3 and can include risk assessments and no effects levels for aquatic life, rather than solely the first two comparisons.

Prediction of the movement of contaminants from sediment into and through pelagic food webs is technically challenging and should only be dealt with if a Tier IV evaluation is necessary. One approach is bioenergetic-based toxicokinetic modeling. These models have been successfully applied to marine (Connolly and Tonelli, 1985) and freshwater (Norstrom et al., 1976) fishes, theoretical food chains (Thomann, 1989), and more recently to sediment organisms (Boese et al., 1990). These models are very data intensive to apply on a chemical and site-specific basis. It is possible to use values determined through QSAR (EPA, 1994a), though the default values may substantially overestimate tissue residues in metabolizable compounds, such as PAH. Another general approach is to bracket likely concentrations of specific contaminants at different trophic levels based on an empirical model derived from a variety of marine food webs (Young, 1988).